CLAIMS

1. A brazing sheet product comprising a core sheet (1), on at least one side of said core sheet (1) a clad layer (2) made of an aluminum alloy containing silicon in an amount in the range of 4 to 14% by weight, and on at least one outersurface of said clad layer (2) a diffusion layer (3) comprising nickel-tin alloy.

2. A brazing sheet product according to claim 1, wherein there is a layer (4) comprising nickel or nickel-alloy between the outersurface of said clad layer (2) and the diffusion layer (3).

3. A brazing sheet product according to claim 2, wherein the layer (4) comprising nickel or nickel-alloy has a thickness of at most 0.4 micron.

4. A brazing sheet product according to claim 2, wherein the layer (4) comprising nickel comprises 96% by weight or more of nickel and bismuth in a range up to 4% by weight.

5. A brazing sheet product according to claim 1, wherein the diffusion layer (3) has a thickness in a range of about 0.2 to 0.6 micron.

6. A brazing sheet product according to claim 1, wherein there is a layer (5) comprising zinc as a bonding layer between said outersurface of said clad layer (2) and said layer comprising nickel (4).

7. A brazing sheet product according to claim 6, wherein said bonding layer (5) has a thickness of not more than 0.5 micron.

8. A brazing sheet product according to claim 6, wherein said bonding layer (5) has a thickness of not more than 0.3 micron.

9. A brazing sheet product according to claim 6, wherein said bonding layer (5) has a thickness in the range of 0.01 to 0.15 micron.

10. A brazing sheet product according to claim 1, wherein the core sheet (1) is made of an aluminum alloy.

11. A brazing sheet product according to claim 1, wherein the core sheet (1) is made of an aluminum alloy selected from the group consisting of AA3xxx, AA5xxx and AA6xxx-series alloys.

12. A brazing sheet product according to claim 1, wherein the clad layer and all layers exterior thereto form a metal filler for a brazing operation and having a composition with the proviso that the mol-ratio of Ni:Sn is in the range of 10:(0.5 to 9).

13. A brazing sheet product according to claim 1, wherein the clad layer and all layers exterior thereto form a metal filler for a brazing operation and having a composition with the proviso that the mol-ratio of Ni:Sn is in the range of 10:(0.5 to 6).

14. A brazing sheet product according to claim 1, wherein taken together the aluminum base substrate of an aluminum alloy comprising silicon in an amount in the range of 4 to 14% by weight and all layers exterior thereto form a metal filler for a brazing operation and having a composition comprising at least, by weight percent:

Si in the range of 5 to 14 %,
Ni in the range of 0.03 to 8%,
Bi in the range of at most 0.3%,
Sb in the range of at most 0.3%,
Sn in the range of 0.01 to 7%,
Zn in the range of at most 0.3%,
Mg in the range of at most 5%,
balance aluminum and inevitable impurities,

with the proviso that the mol-ratio of Ni:Sn is in the range of 10:(0.5 to 9).

15. A brazing sheet product according to claim 1, wherein the brazing sheet product has a post-braze corrosion life of 7 days or more in a SWAAT-test with perforations in accordance with ASTM G-85.

16. A method of manufacturing of an aluminum brazing product, which method comprises the steps of:

(a) providing an aluminum base substrate layer of an aluminum alloy comprising silicon in an amount in the range of 4 to 14% by weight,

(b) applying a metal layer comprising nickel or nickel-alloy onto at least one outersurface of said aluminum substrate,

(c) applying a metal layer comprising tin or tin-alloy onto the outersurface of the layer comprising nickel or nickel-alloy, and

(d) subjecting the coated brazing product to a diffusion annealing treatment by holding the plated brazing product at a temperature in the range of 100 to 500°C for a period of 1 sec. to 300 minutes to form on the outersurface of said aluminum base substrate a diffusion layer comprising nickel-tin alloy.

17. A method according to claim 16, wherein the metal layer comprising nickel or nickel-alloy is applied using a plating method.

18. A method according to claim 16, wherein the metal layer comprising nickel or nickel-alloy is applied using an electrolytic plating method.

19. A method according to claim 16, wherein metal layer comprising nickel or nickel-alloy is applied using a PVD method.

20. A method according to claim 16, wherein metal layer comprising nickel or nickel-alloy is applied using a CVD method.

21. A method according to claim 16, wherein metal layer comprising nickel or nickel-alloy is applied using a thermal spraying method.

22. A method according to claim 16, wherein the metal layer comprising tin or tin-alloy is applied using a plating method.

23. A method according to claim 16, wherein the metal layer comprising tin or tin-alloy is applied using an electrolytic plating method.

24. A method according to claim 16, wherein metal layer comprising tin or tin-alloy is applied using a PVD method.

25. A method according to claim 16, wherein metal layer comprising tin or tin-alloy is applied using a CVD method.

26. A method according to claim 16, wherein metal layer comprising tin or tin-alloy is applied using a thermal spraying method.

27. A method according to claim 16, wherein the diffusion annealing treatment is carried out in a protective atmosphere.

28. A method according to claim 16, wherein the diffusion annealing treatment is carried out in a temperature range of 230 to 350°C.

29. A method according to claim 16, wherein the diffusion annealing treatment is carried out in a temperature range of 230 to 350°C for a soaking time in the range of 1 to 600 sec.

30. A method according to claim 16, wherein the diffusion annealing treatment is carried out in a temperature range of 230 to 350°C for a soaking time in the range of 1 to 300 sec.

31. A method according to claim 16, wherein the clad layer and all layers exterior thereto form a metal filler for a brazing operation and having a composition with the proviso that the mol-ratio of Ni:Sn is in the range of 10:(0.5 to 9).

32. A method according to claim 16, wherein the clad layer and all layers exterior thereto form a metal filler for a brazing operation and having a composition with the proviso that the mol-ratio of Ni:Sn is in the range of 10:(0.5 to 6).

33. A method according to claim 16, wherein taken together the aluminum base substrate of an aluminum alloy comprising silicon in an amount in the range of 4 to 14% by weight and all layers exterior thereto form a metal filler for a brazing operation and having a composition comprising at least, by weight percent:

Si in the range of 5 to 14 %,
Ni in the range of 0.03 to 8%,
Bi in the range of at most 0.3%,
Sb in the range of at most 0.3%,
Sn in the range of 0.01 to 7%,
Zn in the range of at most 0.3%,
Mg in the range of at most 5%,

balance aluminum and inevitable impurities,
with the proviso that the mol-ratio of Ni:Sn is in the range of 10:(0.5 to 9).

34. A method according to claim 16, wherein the aluminum base substrate is made of an AA4000-series aluminum alloy.

35. A method according to claim 16, wherein the aluminum base substrate is an aluminum alloy sheet coupled to a core sheet made of an aluminum alloy.

36. A method according to claim 35, wherein the core sheet is made of an aluminum alloy selected from the group consisting of AA3xxx, AA5xxx and AA6xxx-series alloys.

37. A method according to claim 35, wherein the aluminum base substrate is aluminum brazing sheet comprising an aluminum core sheet coupled on at least one surface of said core sheet to the aluminum base substrate formed by an aluminum clad layer made of an AA4xxx-series aluminum alloy.

38. A method according to claim 16, wherein prior to plating according to step (b), there is deposited onto the outersurface of the aluminum substrate a bonding layer comprising zinc.

39. A method according to claim 16, wherein prior to plating according to step (b), there is deposited onto the outersurface of the aluminum substrate a bonding layer comprising zinc said bonding layer having a thickness of not more than 0.5 micron.

40. A method according to claim 16, wherein prior to plating according to step (b), there is deposited onto the outersurface of the aluminum substrate a bonding layer comprising zinc said bonding layer having a thickness of not more than 0.3 micron.

41. A method according to claim 16, wherein the diffusion annealing treatment is to form a layer comprising nickel on the outersurface of said aluminum base substrate layer and a diffusion layer comprising nickel-tin alloy on the outersurface of said layer comprising nickel.

42. A method according to claim 16, wherein the diffusion layer (3) has a thickness in the range of about 0.2 to 0.6 micron.

43. An assembly of components joined by brazing, and wherein at least one of said components being a brazing sheet product according to claim 1.

44. An assembly of components joined by brazing, and wherein at least one of said

components being the product obtained by the method according to claim 16.

45. An assembly according to claim 43, wherein the components are joined by means of a brazing operation in an inert atmosphere in the absence of a brazing flux material.

46. An assembly according to claim 43, wherein the components are joined by means of a brazing operation using a vacuum.

47. An assembly according to claim 43, wherein parts made from said brazing sheet product have a post-braze corrosion life of 6 days or more in a SWAAT-test without perforations in accordance with ASTM G-85.

48. An assembly according to claim 43, wherein at least one other of said components comprises a material selected from the group consisting of steel, aluminized steel, stainless steel, plated or coated steel, plated or coated stainless steel, bronze, brass, nickel, nickel alloy, titanium, and plated or coated titanium.

49. An assembly according to claim 43, wherein the assembly is a heat exchanger for automotive application.

50. An assembly according to claim 43, wherein the assembly is a fuel cell.

51. An assembly according to claim 43, wherein the assembly is an electrochemical fuel cell.

52. An assembly according to claim 44, wherein the components are joined by means of a brazing operation in an inert atmosphere in the absence of a brazing flux material.

53. An assembly according to claim 44, wherein the components are joined by means of a brazing operation using a vacuum.

54. An assembly according to claim 44, wherein parts made from said brazing sheet product have a post-braze corrosion life of 6 days or more in a SWAAT-test without perforations in accordance with ASTM G-85.

55. An assembly according to claim 44, wherein at least one other of said components comprises a material selected from the group consisting of steel, aluminized steel, stainless steel, plated or coated steel, plated or coated stainless steel, bronze, brass, nickel, nickel alloy, titanium, and plated or coated titanium.

56. An assembly according to claim 44, wherein the assembly is a heat exchanger for automotive application.

57. An assembly according to claim 44, wherein the assembly is a fuel cell.

58. An assembly according to claim 44, wherein the assembly is an electrochemical fuel cell.